UNIVERSITI SAINS MALAYSIA

1st. Semester Examination
2000/2001 Academic Session

SEPTEMBER / OCTOBER 2000

EAH324/3 – RIVER ENGINEERING

Time : [3 hours]

Instruction to candidates:-

1. This paper consists of **SEVEN (7)** questions. Answer **FIVE (5)** questions only.

2. Answers **MUST BE** written in Bahasa Malaysia.

Questions 1, 2 and 3 refer to the data as given in Tables 1 to 3 based on samplings done at Station SP2, Pari River, Ipoh on 2 December 1998 and 11 February 1999:

Table 1 Cross Sections

Distance from Left Bank (m)	Bed Elevation (m)	
	2 December 1998	11 February 1999
0.0	35.68	35.68
2.0	35.68	35.65
4.0	35.68	35.75
6.0	35.83	35.78
8.0	35.78	35.75
10.0	35.83	35.78
12.0	35.73	35.80
14.0	35.68	35.93
16.0	35.68	35.92
18.0	35.68	35.93
Water Elevation (m)	37.03	36.34

Table 2 Bed Material

Particle Size (mm)	% Passing	
	2 December 1998	11 February 1999
25.00	100.00	100.00
12.50	96.23	100.00
9.50	95.47	96.53
6.70	89.70	94.33
4.75	85.27	91.00
4.00	69.17	86.00
3.35	54.93	75.87
2.36	44.37	67.00
2.00	22.20	45.43
1.18	10.60	36.16
0.71	4.07	13.73
0.60	2.50	6.57
0.425	0.60	2.38
0.30	0.00	0.60
0.15	0.00	0.00

Table 3 Flow and Sediment Characteristics

Data	2 December 1998	11 February 1999
Q (m^3/s)	23.71	5.06
B (m)	18.0	18.0
Y_o (m)	1.30	0.53
V (m/s)	1.0	0.54
S_o	0.00125	0.00125
Q_T (kg/s)	6.04	4.0

1. (a) Sketch cross-sectional changes for both samplings. Estimate the maximum erosion or deposition if the design bed elevation is 35.18.

(10 marks)

(b) Determine the mode of transport for both samplings. (10 marks)

2. (a) Calculate bed load transport rate for the sampling done on **2 December 1998** using the following equations:

- **Einstein-Brown**
- **Shields**

(10 marks)

(b) Estimate the total bed material load using **Yang** equation for the sampling done on **2 December 1998**. Compute the discrepancy ratio for the equation.

(10 marks)

3. (a) Determine the bedform for both samplings using **diagram Shields**. (10 marks)

(b) Compute the water elevation predicted by the following equations for the sampling carried out on **11 February 1999:**

- **Lacey**
- **Sugio**

(10 marks)

4. (a) Discuss **TWO (2)** effects on river equilibrium due to urbanisation. (10 marks)

(b) Discuss **TWO (2)** factors influencing the local scour around bridge piers.

(10 marks)

5. Design a river channel with rigid concrete banks with the following flow and sediment characteristics:

Q (m^3/s)	35 m^3/s
D_{50} (mm)	4
Manning's n	0.035
S_o	0.00125

The river reach has a rectangular cross section.

Apply the following two methods:

- Permissible Velocity based on Yang equation. (10 marks)
- Critical Shear Stress based on Shields diagram. (10 marks)

6. (a) Describe the following:

(i) regime concept
(ii) open system concept
(iii) genetic approach
(iv) Bankfull discharge
(v) sinusity

(10 marks)

(b) Clearly sketch the plan view and cross-section of a meandering river. Show all the features of a meandering river on the sketch and describe the formation process of all the features shown.

(10 marks)

7. Describe the local, upstream and downstream effects resulting from the following projects:

(i) river straightening
(ii) dam construction

(20 marks)

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APPENDIX

Table A1: Diagram Shields (Van Rijn 1984)

D_{gr}	$\frac{\tau_C}{\rho g (S_s - 1) d}$
$D_{gr} \leq 4$	$0.24 \ D_{gr}^{-0.1}$
$4 < D_{gr} \leq 10$	$0.14 \ D_{gr}^{-0.64}$
$10 < D_{gr} \leq 20$	$0.04 \ D_{gr}^{-0.10}$
$20 < D_{gr} \leq 150$	$0.013 \ D_{gr}^{0.29}$
$D_{gr} > 150$	0.055

Yang Equation (Sand River)

$$\log C_T = 5.435 - 0.286 \log \frac{W_S d}{\nu} - 0.457 \log \frac{U_*}{W_S}$$

$$+ \left(1.799 - 0.409 \log \frac{W_S d}{\nu} - 0.314 \log \frac{U_*}{W_S} \right)$$

$$\times \log \left(\frac{V S_0}{W_S} - \frac{V_C S_0}{W_S} \right)$$

di mana $C_V (\text{ppm}) = \frac{C_T (\text{ppm})}{S_S}$

Halaju kritikal, V_C diberikan oleh :-

- $\frac{V_C}{W_S} = \frac{2.5}{\left(\log \frac{U_* d}{\nu} - 0.06 \right)} + 0.66$

bagi $\text{Re}_* = \frac{U_* d}{\nu} = 1.15 - 70$

- $\frac{V_C}{W_S} = 2.05$ bagi $\text{Re}_* > 70$

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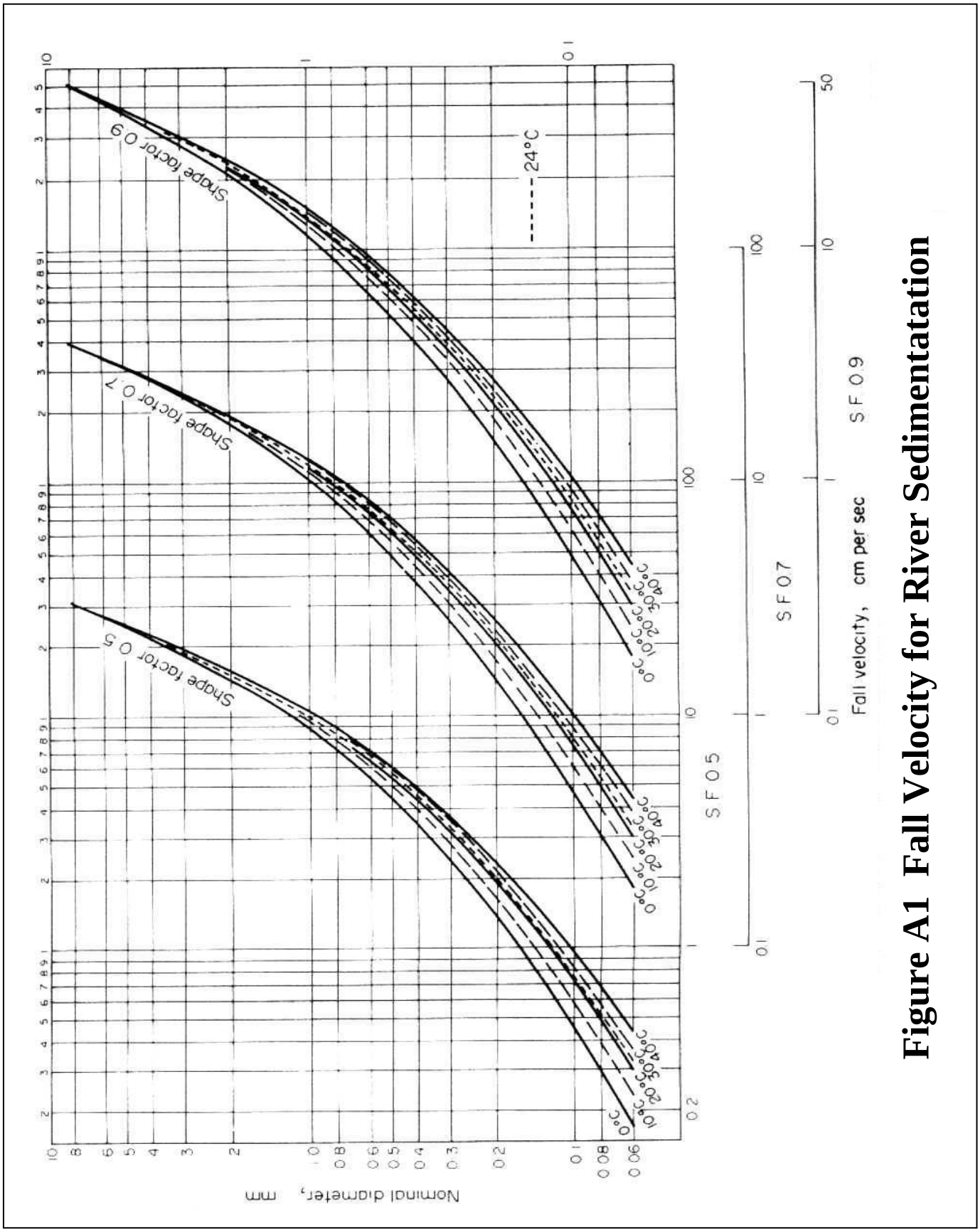

Figure A1 Fall Velocity for River Sedimentation

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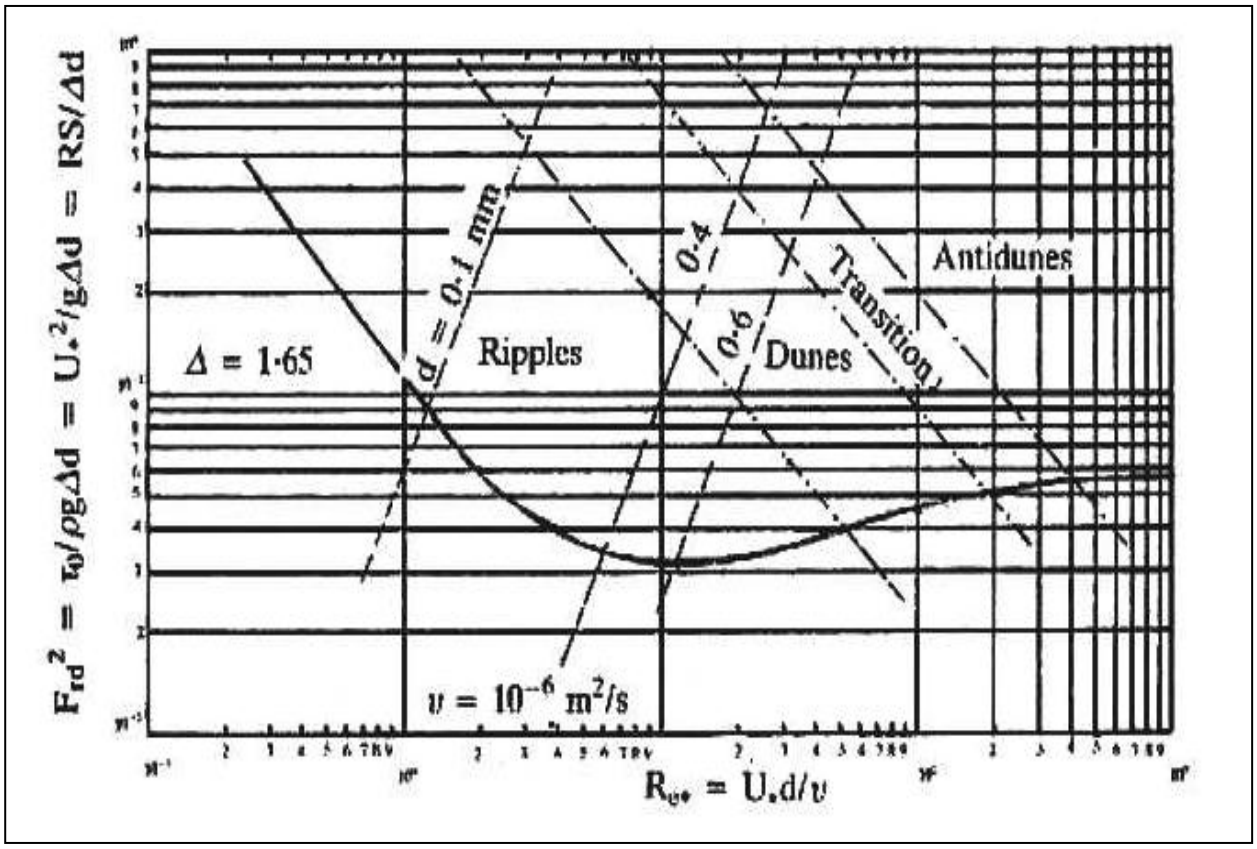

Figure A2 Shields Diagram